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Use of Renewable Adsorbent (Peanut Husk) for the Treatments of Textile Waste Water

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ABSTRACT

Colored textile effluents represent severe environmental problems as they contain mixture of chemicals, auxiliaries and dyestuffs of different classes and chemical constitutions. Elimination of dyes in the textile wastewater by conventional wastewater treatment methods is very difficult. At present, there is a growing interest in using inexpensive and potential materials for the adsorption of reactive dyes[1]. **Peanut husk** has been reported to be a potential media to remove color from wastewater. In this study, **Peanut husk** were used as an adsorbent. The results showed that the selected bio adsorbents have good potential for removal of reactive dyes from textile effluent.

Keywords: Effluent, Temperature, Treatment, Adsorbent, Biochemical oxygen demand, Chemical oxygen demand, DO, Wastewater.

INTRODUCTION

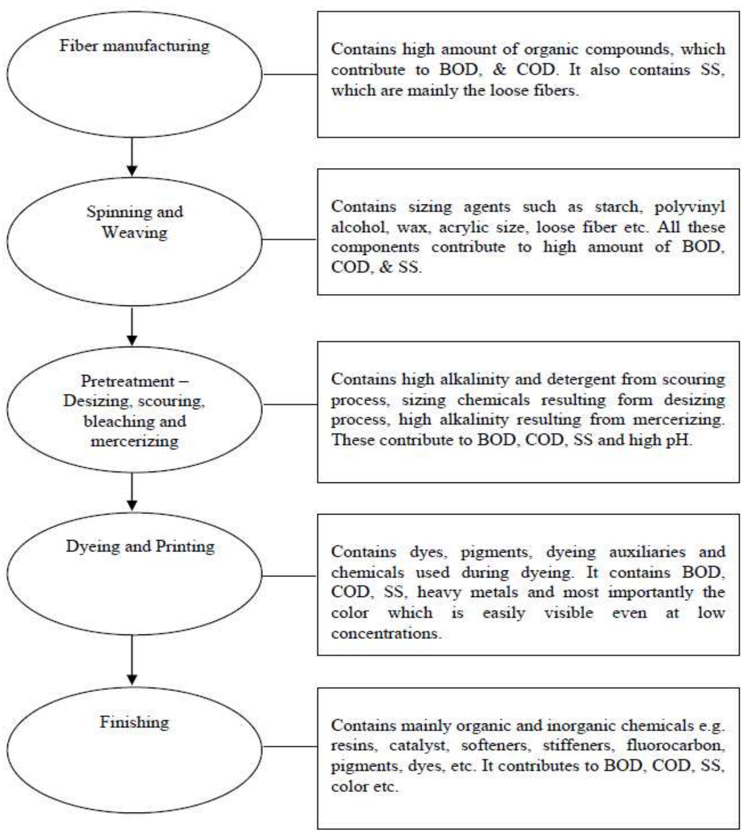
The textile industry is one of the most complicated industries among manufacturing industry. Wastewater treatment is one of the major problems faced by textile manufacturers[2]. Wastewater from the textile industry can contain a variety of polluting substances including dyes. The Color is the first contaminant to be recognized in the wastewater and has to be removed before discharging into water bodies or on land. The presence of very small amounts of dyes in water (less than 1

ppm for some dyes) is highly visible and affects the aesthetic merit, water transparency and gas solubility in lakes, rivers and other water bodies. Dyes, however, are more difficult to treat because of their synthetic origin and mainly complex aromatic molecular structures[3].

Adsorption is an effective method of lowering the concentration of dissolved dyes in the effluent resulting in color removal. Other means of dye removal such as chemical oxidation, coagulation and reverse osmosis are generally not feasible due to economic considerations (Tsai *et al.,* 2001).

The adsorption process is one of the most efficient methods to remove dyes from effluent. The process of adsorption has an edge over the other methods due to it sludge free clean operation and complete removal of dyes even from dilute solution. **Pea nut husk** are the newly thought adsorbents because of their extended surface area, micro porous structure, high adsorption capacity and high degree of reactivity[4]. Pea nut husk are totally new adsorbents for waste water treatment. For that reason I have used these adsorbents for wastewater treatment.

Wastewater characteristics versus different textile process



EXPERIMENTAL MATERIALS & METHODS

List of total materials

Chemicals & others, Sunfix red Reactive dye, Hydrochloric acid, Sodium hydroxide, Hydrogen per Oxide, Sodium carbonate, Acetic acid, Distilled water.

Bio-adsorbents & Waste Water Collection

The bio-adsorbent used for this study were the pea nut husk which was collected from Bhola, Bangladesh.

The sample waste water was collected from Givency Group (Wet Processing Unit), Gazipur, Bangladesh.

Instruments

Glassware and apparatus, UV-Vis Spectrophotometer, Portable multi-parameter meter, Electronic balance, Vacuum Oven, Magnetic/ Hotplate stirrer, Incubator, Refrigerator

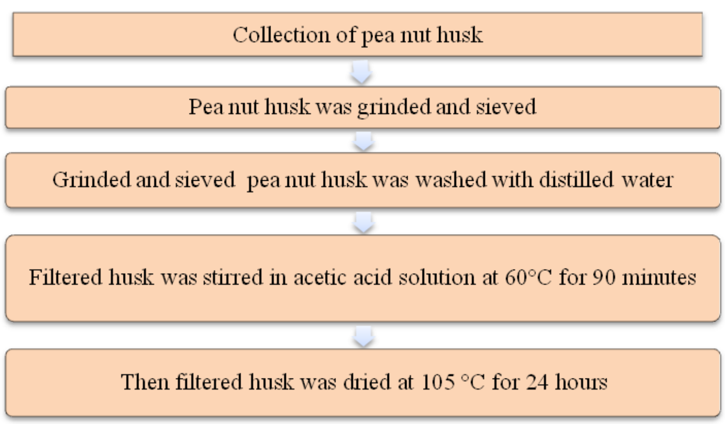
Experimental Methods:

Preparation of standard solution:

A stock solution of Sunfix Red dye was prepared by dissolving a mixture of 0.1 g of dye in a 1000 mL volumetric flask followed by dilution up to the mark addition of de-ionized water. Dye test solution was prepared through proper dilution of the stock solution to the desired concentration. De-ionized water was used to prepare all of the solution in this study.

Adsorbent preparation

Pea nut husk was prepared in the following steps.



Adsorption and Analytical Procedures

Pea nut husk (2.5 g) was added to the beaker. The adsorption experiments were carried out in beakers. Adsorption factors including the amount of adsorbents (2.5 g), initial sample concentration for waste water and dye solutions 100 mL and 10 mg/L respectively, contact time 180 minutes and pH 7 were evaluated. After the adjustment

of pH to the desired value with 0.01 M HCL and 0.01 M NaOH solutions, the sample solution was stirred using a magnetic stirrer. The adsorption from the aqueous solution was studied. After the desired contact period for each batch experiment, the aqueous phases were separated from the materials, and the dye concentration of dye was measured using a UV-Vis Spectrophotometer.

Determination of physical and chemical characteristics of wastewater

Total Solids

Total solids were obtained by evaporating 50 mL waste water sample in a beaker. After evaporating the sample the solid residues were dried.

Analysis: It was determined by conventional method.

Total Dissolved Solids (TDS)

Total dissolved solids contents of water and waste water is defined as the residue left upon evaporation at 103°C to 105°C. Total Dissolved Solids was obtained by evaporating 50 mL filtered waste water sample in a beaker. After evaporating the sample the solid residues were dried.

Analysis: It was determined by using a digital TDS meter.

Total Suspended Solids

Total Suspended Solids was obtained by deducting Total Dissolved Solids from Total solids.

Dissolved Oxygen (DO)

Dissolved oxygen shows the ability of the stream to purify itself through biochemical process. Oxygen is dissolved in most waters in varying concentrations. The Dissolved Oxygen of waste water sample was measured by taking 50 mL of wastewater in a 100 mL beaker and immersing the electrode of portable multi parameter meter (Sension 153,HACH,USA) into the sample.

Analysis: It was determined by digital DO meter or by conventional trite-metric method.

Biological Oxygen Demand (BOD)

Bio-chemical oxygen demand tests show the amount of molecular oxygen required by bacteria to reduce the carbonaceous materials. The determination of DO of a sample before and after five days incubation at 20°C is the basic of BOD determination.

Analysis: It was determined by Winkler's method of 5 day BOD test.

Chemical Oxygen Demand (COD)

COD test shows the oxygen equivalent of the organic matter that can be oxidized by using a strong oxidizing agents e.g. potassium dichromate in acidic solution, at elevated temperature, for two and half hour. It indicates the amount of oxygen required to oxidize the carbonaceous matter.

Analysis: It was determined by closed/open refluxed trite-metric method.

pH

pH is a term used universally to express the intensity of the acidic or alkaline condition of solution. It is a measure of hydrogen ion concentration or more precisely the hydrogen ion activity.

Analysis: It was determined by digital pH meter.

Analysis of samples by UV-Vis Spectrophotometer

The amounts of dye onto the adsorbents were determined by measuring the absorbance of dye after batch experiment by UV-Vis Spectrophotometer. The sample were analyzed against a calibration curve prepare by standard solution of dye.

RESULTS & DISCUSSIONS

Waste water parameter before & after treatment by adsorbent (Peanut Husk)

Parameter	Before treatment	After Treatment by Peanut Hust
P^H	11	7
Dissolved oxygen (mg/L)	6.8	9.2
Biological Oxygen Demand(mg/L)	98	45.4
Chemical Oxygen Demand (mg/L)	992	310
Total Solids (mg/L)	3444	2210
Total Dissolved Solid(mg/L)	3224	2080
Total Suspended Solids (mg/L)	220	125

Graphical representation of different parameters

From the above result it is clearly shown that the pH, BOD, COD, TS, TDS,TSS has reduced & DO has increased which is remarkable.

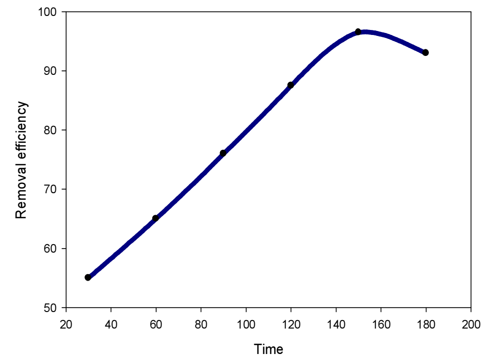


Figure 1: Effect of contact time for Peanut husk

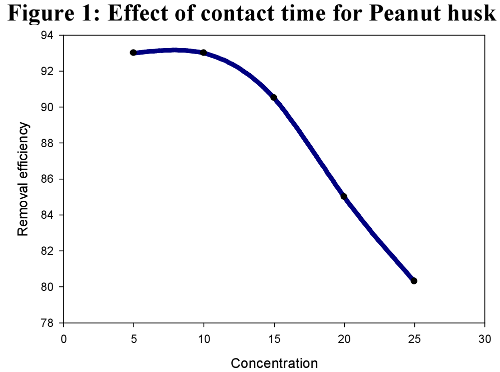


Figure 2: Effect of dye concentration for Peanut husk

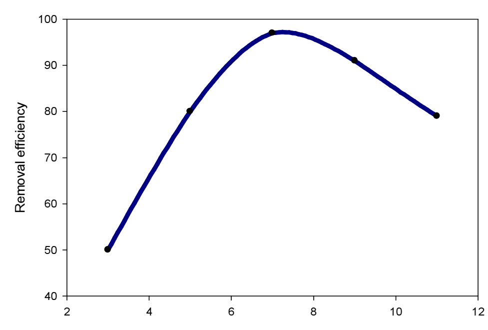


Figure-3: Effect of pH for Peanut husk

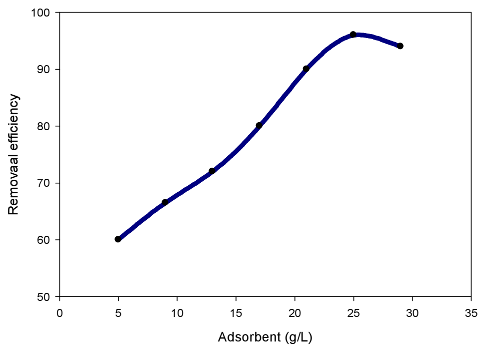


Figure 4: Effect of Adsorbent variation for Peanut husk

Figure 1: Effect of contact time

The contact time between pollutant and the adsorbent is of significant importance in the wastewater treatment by adsorption. A rapid uptake of pollutants and establishment of equilibrium in short period signifies the efficiency of that adsorbate for its use in wastewater treatment. Available adsorption studied in literature reveal that the uptake of the adsorbate species is fast at the initial stages of the contact period, and therefore, it becomes slower near the equilibrium. The effects of contact time for the adsorption of Sunfix red was studied for a period of 210 min and the results are shown in the above figures(figure- a). It showed that the dye removal was rapid at a certain time then the rate was decreased after saturation. In case of figure, Pea nut husk showed highest absorptive capacity at 150 minutes.

Figure 2: Effect of initial dye concentration (Batch process)

The effect of initial Sunfix Red reactive dye concentration for their removal by Peanut husk is shown in the figure (figure-b). From these figures it is proved that as the initial dye concentration increased, the adsorption capacity decreased. From the graph, it is clear that Peanut husk has higher adsorptive capacity at 10 ppm..

Figure 3: Effect of pH variation

The pH of the solution affects the surface charge of the adsorbents as well as the degree of ionization of different pollutants. Change of pH also affects the adsorptive process through dissociation of functional groups on the adsorbent surface active sites. Consequently, this leads to a shift in reaction kinetics and adsorption equilibrium. The effect of pH of sunfix red on Peanut husk is shown in the figure above(figure- c). In graph, Peanut husk showed the maximum dye adsorption 97 % at pH 7

Figure 4: Effect of adsorbent dosage (Batch process):

The effects of peanut husk dosage on the removal of sunfix red are shown in (Fig. 4) . The percentage removal increased with the adsorbent dosage up to a certain limit then it reached to the constant value. Pea nut husk showed the maximum dye adsorption 98 % at adsorbent of 25 g/L.

It was found from the graph that the removal of dye by Pea nut husk adsorbents increases with an increase in the adsorbent dosage (w) initially and, thereafter, becomes constant after some value of *w*. This value is taken as the optimum dosage *w.* The increase in adsorption with the adsorbent dosage can

be attributed to the availability of greater surface area and larger number of adsorption sites. At w < *optimum*, the adsorbent surface becomes saturated with dye particle and the residual dye concentration in the solution is large. With an increase in *w*, the dye removal increases due to increased amount of adsorbent

CONCLUSION

In this research work, the removal percentage of reactive dyes from the textile waste water was carried out by the application of bio adsorbents Peanut husk). When the initial pH is 7, initial concentration is 10 ppm and temperature is 45°C then the maximum amount of the reactive dyes adsorbed by **Peanut husk**. 98% removal of dye was found at adsorbent mass of 25 gm/L, pH 7 and 180 minutes of contact time by Peanut Husk.

De colorizations process is not specific and depends upon many factors. Although there are lots of adsorbents which can act as a substitute for the expensive commercial activated carbon but complete replacement is not possible. The factors which favors the selection of Peanut husk are its low cost, widespread presence and organic composition which shows strong affinity for some selected dyes. In spite of the scarcity of consistent cost information, the widespread uses of low-cost adsorbents in industries for wastewater treatment applications today are strongly recommended due to their local availability, technical feasibility, engineering applicability, and cost effectiveness.

The adsorption can be influenced by a number of factors, such as, adsorbent mass, contact time, agitation speed, temperature and pH etc. Hence, there is a need to optimize these factors to maximize the treatment efficiency of Pea nut husk and minimize the treatment cost for textile wastewater[5].

If low-cost adsorbents perform well in removing heavy metals and colors at low cost, they can be adopted and widely used in industries not only to minimize cost inefficiency, but also improve profitability.

REFERENCES

1. R.S.Mane, V.N. Bhusari, Removal of Colour (dyes) from textile effluent by adsorption using Orange and Banana peel, ISSN: 2248-9622*, International Journal of Engineering Research and Applications*, Vol. 2, Issue 3, pp.1997-2004 May-Jun (2012).
2. H. Najafi and H. R. Movahed , Improvement of COD and TOC reactive dyes in textile wastewater by coagulation chemical material, ISSN 1684–5315, *African Journal of Biotechnology,* Vol. 8 (13), pp. 3053-3059, 6 July (2009),
3. Thomas E. (Tom) Schultz, Biological wastewater treatment, International *Journal of Environmental Science,* pp. 3, October (2005).
4. Rahman Muhammad Bozlur, Shinichi Shibata, C. Siddiqua Farah Diba and Magali Uono, Low Cost Biodegradable Adsorbent Material for the Removal of Dissolved Dyes from Aqueous Solutions, ISSN: 1793-8236, *IACSIT International Journal of Engineering*

and Technology, Vol.2, No.5, October (2010).

5. Piyush Malaviya, Textile Wastewater Treatment Using Sawdust as Adsorbent, ISSN: 2277-1948, *International Journal of Environmental Sciences*, Vol.2 No.3. Pp. 110-113, (2013).